

Amendment dated: January 21, 2004
Reply to Final Office Action of October 21, 2003

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently Amended) A valve for controlling fluid flowing through a valve body during successive strokes of the valve by controlled movement relative to a passage in the valve body, the valve comprising:

a regulating portion having a tip connected with a valve seat for engaging with a valve body seat to define a closed position of the valve body passage, the valve seat non-separably connected with the regulating portion, said regulating portion having a plurality of channels formed in an outer circumferential surface thereof, each of said channels defining a greater open area cross-section at a point nearer a tip of the regulating portion than a point nearer the valve seat so that greater flow can be obtained as the regulating portion is controllably moved relative to the valve body passage, at least one of said channels having an open area shape different from the open area shape of at least one other channel at the same cross-section location of the regulating portion, wherein, at each cross section location of the stroke of the regulating portion, the open area cross-sections of said channels are symmetrically arranged to provide balanced fluid flow through the valve body, said outer circumferential surface being parallel to the direction of stroke of the valve, and wherein said valve further comprises a fluid boundary element movably operably connected to the valve for mounting the valve to the valve body.

2. (Original) The valve of claim 1, wherein said channels are formed in the regulating portion of the valve wherein at least one channel extends further toward the seat of the regulating portion than at least one other channel, so that fluid flowing through a valve body containing the valve can flow in a staged increase in flow as the valve regulating portion is controllably moved relative to the valve body passage.

Amendment dated: January 21, 2004

Reply to Final Office Action of October 21, 2003

3. (Original) The valve of claim 1, wherein at least one of said channels has an open area shape at a cross-section location of the regulating portion that is substantially triangular.

4. (Original) The valve of claim 1, wherein at least one of said channels has an open area shape at a cross-section location of the regulating portion that is substantially rectangular.

5. (Original) The valve of claim 1, wherein at least two of said channels have an open area shape at a cross-section location of the regulating portion that is substantially triangular.

6. (Cancelled)

7. (Original) The valve of claim 1, wherein at least two of said channels has an open area shape at a cross-section location of the regulating portion that is substantially rectangular.

8. (Cancelled)

9. (Original) The valve of claim 1, wherein said channels comprise four channels having an open area shape at a cross-section location of the regulating portion that is substantially rectangular and four channels having an open area shape at a cross-section location of the regulating portion that is substantially triangular, said rectangular channels alternating with said triangular channels in symmetrical placement on said regulating portion.

10. (Original) The valve of claim 9, wherein said channels are formed in the regulating portion of the valve wherein the rectangular channels extend further toward the seat of the regulating portion than the triangular channels, so that fluid flowing through a valve

Amendment dated: January 21, 2004

Reply to Final Office Action of October 21, 2003

body containing the valve can flow in a staged increase in flow as the valve regulating portion is controllably moved relative to the valve body passage.

11. (Original) The valve of claim 1, wherein the fluid boundary element comprises a bellows.

12. (Original) The valve of claim 1, wherein the fluid boundary element comprises a diaphragm.

13. (Original) The valve of claim 1, wherein the fluid boundary element comprises a flexible sleeve.

14. (Original) The valve of claim 1, wherein the valve is made from a fluoropolymer.

15. (Currently Amended) A valve for controlling fluid flowing through a valve body during successive strokes of the valve by controlled movement relative to a passage in the valve body, the valve comprising:

a regulating portion having a tip connected with a valve seat for engaging with a valve body seat to define a closed position of the valve body passage, the valve seat non-separably connected with the regulating portion, said regulating portion having a plurality of channels formed in an outer circumferential surface thereof, each of said channels defining a greater open area cross-section at a point nearer a tip of the regulating portion than a point nearer the valve seat so that fluid flowing through a valve body containing the valve can flow in a staged increase in flow as the valve regulating portion is controllably moved relative to the valve body passage, wherein at least one channel extends further toward the seat of the regulating portion than at least one other channel, said outer circumferential surface being parallel to the direction of stroke of the valve, wherein, at each cross section location of the stroke of the regulating portion, the open area cross-sections of said channels are symmetrically arranged to provide balanced fluid flow through the valve body, and wherein said valve further comprises a fluid boundary

Amendment dated: January 21, 2004
Reply to Final Office Action of October 21, 2003

element movably operably connected to the valve for mounting the valve to the valve body.

16. (Currently Amended) A valve assembly for controlling fluid flowing through a valve body during successive strokes of a valve by controlled movement relative to a passage in the valve body, comprising:

a valve body having a fluid transfer housing having a valve body passage disposed therein, a fluid inlet and outlet in communication with the valve body passage, and a valve body seat positioned within the valve body passage between the fluid inlet and outlet;

a valve actuator housing connected with the fluid transfer housing and having a valve actuator disposed therein;

a valve attached to the end of the valve actuator and having a regulating portion disposed at least partially within the valve body passage, wherein the valve comprises:

a regulating portion having a tip connected with a valve seat for engaging with a valve body seat to define a closed position of the valve body passage, the valve seat non-separably connected with the regulating portion, said regulating portion having a plurality of channels formed in an outer circumferential surface thereof, each of said channels defining a greater open area cross-section at a point nearer a tip of the regulating portion than a point nearer the valve seat so that greater flow can be obtained as the regulating portion is controllably moved relative to the valve body passage, at least one of said channels having an open area shape different from the open area shape of at least one other channel at the same cross-section location of the regulating portion, said outer circumferential surface being parallel to the direction of stroke of the valve, wherein, at each cross section location of the stroke of the regulating portion, the open area cross-sections of said channels are symmetrically arranged to provide balanced fluid flow through the valve body, and wherein said valve further comprises a fluid boundary element movably operably connected to the valve and to the valve body to segregate fluid from the valve actuator;

Amendment dated: January 21, 2004

Reply to Final Office Action of October 21, 2003

said regulating portion being sized to form a non-interference fit within the valve passage so that a leak-tight fitting is formed only when the valve seat is in contact with the valve body seat.

17. (New) A valve for controlling fluid flowing through a valve body during successive strokes of the valve by controlled movement relative to a passage in the valve body, the valve comprising:

a regulating portion having a tip connected with a valve seat for engaging with a valve body seat to define a closed position of the valve body passage, said regulating portion having a plurality of channels formed in an outer circumferential surface thereof, each of said channels defining a greater open area cross-section at a point nearer a tip of the regulating portion than a point nearer the valve seat so that greater flow can be obtained as the regulating portion is controllably moved relative to the valve body passage, at least one of said channels having an open area shape different from the open area shape of at least one other channel at the same cross-section location of the regulating portion wherein at least one of said channels has an open area shape at a cross-section location of the regulating portion that is substantially rectangular, wherein, at each cross section location of the stroke of the regulating portion, the open area cross-sections of said channels are symmetrically arranged to provide balanced fluid flow through the valve body, said outer circumferential surface being parallel to the direction of stroke of the valve, and wherein said valve further comprises a fluid boundary element movably operably connected to the valve for mounting the valve to the valve body.

18. (New) The valve of claim 17, wherein said channels are formed in the regulating portion of the valve wherein at least one channel extends further toward the seat of the regulating portion than at least one other channel, so that fluid flowing through a valve body containing the valve can flow in a staged increase in flow as the valve regulating portion is controllably moved relative to the valve body passage.

Amendment dated: January 21, 2004
Reply to Final Office Action of October 21, 2003

19. (New) The valve of claim 17, wherein at least one of said channels has an open area shape at a cross-section location of the regulating portion that is substantially triangular.
20. (New) The valve of claim 17, wherein at least two of said channels have an open area shape at a cross-section location of the regulating portion that is substantially triangular.
21. (New) The valve of claim 17, wherein at least two of said channels has an open area shape at a cross-section location of the regulating portion that is substantially rectangular.
22. (New) The valve of claim 17, wherein said channels comprise four channels having an open area shape at a cross-section location of the regulating portion that is substantially rectangular and four channels having an open area shape at a cross-section location of the regulating portion that is substantially triangular, said rectangular channels alternating with said triangular channels in symmetrical placement on said regulating portion.
23. (New) The valve of claim 22, wherein said channels are formed in the regulating portion of the valve wherein the rectangular channels extend further toward the seat of the regulating portion than the triangular channels, so that fluid flowing through a valve body containing the valve can flow in a staged increase in flow as the valve regulating portion is controllably moved relative to the valve body passage.
24. (New) The valve of claim 17, wherein the fluid boundary element comprises a bellows.
25. (New) The valve of claim 17, wherein the fluid boundary element comprises a diaphragm.

Amendment dated: January 21, 2004

Reply to Final Office Action of October 21, 2003

26. (New) The valve of claim 17, wherein the fluid boundary element comprises a flexible sleeve.

27. (New) The valve of claim 17, wherein the valve is made from a fluoropolymer.